"Navigating the Information Economy"

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Introduction

I would like to begin by thanking the Conference Organising Committee and its Chair, Gaynor Austen for the invitation to be here with you for the Conference. I am honoured to be with you, not only as a speaker but as a peer member of the international technological university community, and a little closer to home, as a member of what is known in this country as the Australian Technology Network or ATN. Based on the five technological universities in Australia, this network is in the early stages of development. It has already made some significant achievements one of which is familiar to you through my colleague, Dr Alan Bundy, who spoke about an ATN initiative in information literacy at the last IATUL Annual Conference. Another achievement is the establishment of ATN WEXDEV, a program designed to provide networking and development opportunities for women in the ATN universities.

In my experience the leaders of university libraries are particularly capable in two areas. One is locating the best restaurants in town, those with not only the best regional menus but also the most reliable diverse wine lists. I'm sure you will sample the evidence of their collective taste and nose over the next few days. The other is planning on a grand scale. I ask myself: what other group of people would be able to hold their 21st Annual Conference so close to the beginning of the 21st Century and be able to signify coming-of-age on so many different levels?

This coincidence highlights the magnitude of the Conference theme, Virtual Libraries: Virtual Communities and the theme for today Unlocking Our Potential in the Knowledge Economy. Implicit in the timing is an opportunity to apply our accumulated experience and expertise to the new challenges and emerging issues that feature in the information ecology that I invite you to navigate with me. I also invite you to chart your own maps and images of this ecology during and following the Conference in light of the circumstances of your own locality and locale. In your discussions with colleagues and your reflections on the Conference I urge you to keep in mind one of IATUL's key Statutes: the purpose of IATUL shall be to promote effective co-operation among its member university libraries.

A cautionary tale

Before we begin our journey I would like to tell you a little about a book that I finished reading earlier this year. It caught my imagination and still lingers in my mind. Set about one hundred years ago, it tells the story of the deadly hurricane that almost destroyed Galveston on the coast of Texas in the worst natural disaster ever to hit the United States. With wind gusts estimated at 200 miles per hour and the power of a sea that at one stage rose four feet in four seconds, the loss of life was appalling in its magnitude and the damage inestimable. Yet this

occurred at a time when the US Weather Bureau had the finest forecasting technologies available.

There are of course different layers to the story. One concerns the personal rivalry between Isaac Cline, the Chief of the Galveston weather station and the instigator of the first Texas-wide weather service, and his brother Joseph who was posted to the Galveston weather station just after Isaac had taken up his position there. Another concerns the deteriorating relationship between the US Weather Bureau and meteorologists in Cuba, marked by turf wars among professional forecasters and experienced weather watchers and overlaid with the ignorance behind 'white weatherman's burden'. Not long before the hurricane hit, the US Weather Bureau cut itself off from the warnings given by the very people who had pioneered the prediction of hurricanes. Of particular relevance to this Conference is the layer of the story that hinges on the technologies associated with weather forecasting. The confidence placed in the technologies and the reputation of the US Weather Bureau was so great that some of the natural signs of the impending hurricane were overlooked - the brick-red sky, an inundation of frogs, unseasonal winds and temperatures, unusual tides. What haunts me about the story, *Isaac's storm* is the misplaced faith in the technologies along with the disregard of experience and expertise. As we move further into a technology-based world we would be silly not to heed these warnings.

Australia as an information society

Whatever we call this present period in the developed world we can be sure that its terrain is more complex than any of the catchy labels would have us believe. Information Age, Digital Economy, Information Revolution, Network Society, Knowledge Economy, Wired Society, Post-Capitalist Society, Connected Society, Information Economy, are terms that tend to be used interchangeably. Rather than discuss the significance of each one, I will use the term 'information society'. What I would like to do is to explore the idea of an information society from different perspectives and then look at the idea through the lens of information. From that point I want to raise a number of issues that are relevant to university libraries and then offer a way forward to some future developments.

Overseas delegates might be interested in a thumbnail sketch of the information society in Australia. This sketch begs the question of how an information society might be identified but I have chosen a few statistics as indicators of recognition of the significance of information to business, industry and education. Your discussions with colleagues and the papers you hear during this week will add substance and balance to the bare outline that I give you. The first set of figures has been sourced from the National Office for the Information Economy (NOIE), the second from the Australian Bureau of Statistics (ABS).

The NOIE now that releases a quarterly statistical report designed to show the readiness of Australians to participate in the information economy, the intensity of economic activity being undertaken on the Internet and the impact this activity is having on Australia. I have drawn on the report released in April 2000.

Readiness

More than 6 million adult Australians were accessing the Internet at November 1999, an increase of more than 100% since February 1998. At the same time nearly 1.8 million households (25%) were connected to the Internet.

Younger Australian adults and families with children that are characterised by high incomes and reside in capital cities are leading the way in the adoption of the Internet.

Large Australian businesses have nearly reached the saturation point in terms of Internet adoption and are nearing saturation point in home pages.

Australian small business shows much lower level of connection to the Internet at 48% compared to medium size firms at 82%.

Intensity

More than 75% of adults accessing the Internet at work or home did so once a week or more.

800,000 adult Australians had purchased or ordered goods over the Internet in the 12 months to November 1999. This was an increase of 183% over the previous year.

21% of SMEs connected to the Internet were engaged in Internet based sales and 22% were actively placing orders for goods and services at February 1999.

Australia is a major driver of business to consumer commerce in the Asia-Pacific.

Impacts

The primary benefits of e-commerce identified by SMEs were access to a much larger potential market, increase in the efficiency of business processes and a reduction in costs.

SMEs' apprehensions with e-commerce centre on concerns about alienating their existing customers and technical issues arising out of lack of computer expertise.

The NOIE has forecast a number of positive macro economic impacts for Australia as a result of the adoption of e-commerce.

E-commerce has had, and will continue to have, a deflationary impact on many product and service categories, which will positively impact on the economy as a whole.

The second set of figures from the ABS was included in a press release from the Australian Library and Information Association during Australian Library Week in May this year. Its focus is on the use of public and educational libraries. Last year, 800,000 Australians over the age of 15 years used the Internet at their public libraries. This represents an increase of 7.2% over the previous year. A further 1.2

million Australians used TAFE and other tertiary institutions to access the Internet, an increase of 20% over the previous year. Of those residents around Australia who were polled in the survey, 50% used their local public libraries. Libraries emerged as our second most popular cultural venue after cinemas.

Australian governments have shown an interest in the concept of an information society for almost a decade. Attempts to develop a policy framework began in 1991 with the House of Representatives Standing Committee's report, *Australia as an information society: Grasping new paradigms*. The purpose of the proposed National Information Policy was to 'promote discussion and understanding of the nature of an information society and to assist citizens, community groups, corporations and government itself to understand how information related changes can improve the quality of life'. Since that time and with changes of government, policy directions for information and communication technologies and the information economy have emerged but there is as yet no broad policy framework of the kind evident for example in the OECD and the United Kingdom.

The strategic framework for the information economy proposed by the current Australian government is intended to provide a social benefit. It is designed so that 'the lives, work and well-being of Australians are enriched, jobs are created, and the national wealth is enhanced, through the participation of all Australians in the growing information economy'. For the moment at least, e-commerce and the Internet are central to policy initiatives in Australia, as we have seen from the figures shown earlier. The attention of government is yet to be turned to consideration of the broader social and cultural implications of an information society. On this point Colin Steele, Australian National University Librarian and one of the Conference speakers has predicted serious consequences unless government commitment to infrastructure includes an approach to coordinated national information content initiatives. He suggests that we need 'a knowledge economy which is part of a wider learning society, in which public good information is available to all sections of society and cutting-edge research information is available to libraries'.

Perspectives on an information society

It is clear from this very brief and highly selective sketch of Australia that there are different ways of viewing an information society. By no means do the indicators I have used capture the richness of learning opportunities, the diversity of ways of working or the blurring of the media boundaries that are familiar to us through our own experience. One writer who reminds us of the complexity of an information society is Frank Webster who offers five different perspectives: technological, economic, occupational, spatial and cultural. Webster is skeptical of many of the claims made for the information society and I commend his rigorous analysis of the work of leading information theorists to you. I want to use his five perspectives to frame our exploration and the Conference theme.

1. Technological

This is now perhaps the most common perspective taken on an information society. After all, information and communication technologies are highly visible in daily living in the developed world. Technology enthusiasts provide regular copy in the popular media with people such

as Bill Gates, Garry Jackson and Larry Ellison commanding attention not only for their companies' innovations but also for the scale of their wealth and influence. It is reasonably simple to track the number of computers, television sets, software packages, cellular phone transmission towers, satellite transmitters and so on that are produced, purchased and installed. Penetration rates can be calculated and take-up rates can be predicted. You may not be aware that Australians have a reputation as speedy adopters of technologies. I have read recently that Australia is in the top five countries with the most Internet users per capita. The most common explanations for this situation are that we suffer from the 'tyranny of distance' within the country and from our relative isolation from the rest of the world as an island continent at the bottom of the globe.

But how do we recognise an information society on this basis? How do we know when we're in it or even near it? And what does it mean? What does it tell us about ourselves? Some objections to this perspective point to the privileging of technology so that it comes to define and describe an entire social world as in the Age of the Computer or the Digital Age. Other objections point to the oversimplification of the processes of technology diffusion implicit in this approach and the misplaced focus on technology as the primary driver of social change. Some would have us believe that the technologies are a force for good and that our lives will be transformed if only we would adopt them, the sooner the better. Their sense of urgency is caught in this advertisement from a recent edition of Time:

> this is the surge economy where more business is condensed into seconds than used to get done in a day. and the only constant is change. in the surge economy, the only way to thrive is to be flexible. intel provides the technology….intel makes the technology that makes you ready for anything. because in the surge economy, long-term business plans aren't written in stone. they're e-mailed every Monday morning.

Our experience of information systems and information networks tells as that in themselves they are no guarantee that information is either accessible or available nor do they always yield the benefits that are promised.

2. Economic

This perspective on an information society has its origins in the work of Fritz Machlup who estimated that 29% of the GNP of the United States was generated by the so-called information industries in the early 1960's. These industries were categorised into five groups: education which included libraries as well as schools and colleges; media of communication which included advertising as well as radio and television; information machines which included musical instruments as well as computers; information services as in insurance and law; and other information-based fields such as research and development activities. Using a modification of Machlup's methodology, Porat demonstrated that by the mid 1970s the United States information sector had grown to 46% of GNP. Since that time though it seems that the growth of this sector of the US economy has not only slowed in comparison with other sectors of the economy but it has also not grown since 1970.

In Australia, there has been considerable interest in this perspective on an information society. Barry Jones established the emergence of an information society in his replication of Porat's study in the 1980s. As a member of the Labor government at the time, Jones was one of the driving forces for the development of a national information policy. Don Lamberton, an information economist, has contributed significantly to international scholarship in this field. He argues strongly for the development of a taxonomy that includes tacit knowledge as a basis for a more useful analysis of the economy, especially in relation to sustained innovation and growth.

In business and industry, economic approaches to information have been extended and applied to the firm and to organisations. Information resources and assets have been hailed as the keys to competitive success and knowledge has achieved prominence as a factor in the intellectual capital of the firm. Peter Drucker writes of a knowledge economy but concedes that the behaviour of knowledge as an economic resource is not yet fully understood. What is clear though is that knowledge is being applied to knowledge itself and that productivity is dependent on the development of new knowledge.

There are a couple of shortcomings evident in the economic perspective. Some commentators suggest that the term 'information economy' is so prominent now not because of the size of the information sector of the economy itself but because of the emergence of the new information technologies. The information economy has come to represent the complex of changes associated with the diffusion of information technology throughout the economy and society as a whole. Other commentators emphasise the need for a conceptual framework that will give knowledge and learning the central focus in the analysis of economic change. Nonetheless there still remains the fundamental question of the extent to which this perspective allows for considerations of the quality of information as well as for the processes of creation, production, distribution and use of information.

The same breathlessness in the announcements of new gee-whiz technologies can also infect announcements about the information economy. This sample is from a book advocating a web-based approach to managing knowledge.

> The Information Age… is dead and gone, replaced by the information economy…. The Information Age was about the building of databases. It was about the rise of computing. Today, the databases are already built; the ninth generation of personal computers is already passing through the marketplace; computing has merged with communications to create connectivity…. [We have] passed into the information economy. In the information economy, intellectual capital, not physical assets, drives everything.

The image presented here ties together the themes of information technology, the economy and knowledge. These are some of the themes that will be explored in more detail during the Conference.

3. Occupational

This perspective on an information society is sometimes linked to economic measures as in the case of Porat's work but it refers primarily to the proportion of the workforce engaged in information work. In his

seminal and extensively cited work *The coming of post-industrial society* Daniel Bell makes two claims about the conditions leading to an information society in the US. The first condition is a change from a goods producing to a service-oriented economy, the second is the growth of white-collar groups in occupational distribution. Although Bell is regarded as the foremost writer on the information society it is telling that he himself seems not to have embraced the term. In a carefully argued critique of Bell's body of work elaborated by personal correspondence, Duff draws attention to three inter-related themes that Bell advances. In addition to the post-industrial information workforce, Bell is concerned also with information flows and the revolution in information technology.

Drucker too writes about occupational groupings and the nature of work that defines post-capitalist society. He distinguishes between knowledge workers and service workers with a porous line between the two groupings. Knowledge workers are concerned with words and ideas, service workers with people and work. Because knowledge is the key economic resource, knowledge workers are the leading social group. Based mainly in organisations, the group encompasses knowledge executives, knowledge professionals and knowledge employees. These people have specialised knowledge and capabilities that they contribute to their organisations. Post-capitalist society is transformed by knowledge and so too are organisations and nations.

Obviously the size of the information workforce is dependent on definitions of information work. Broad groupings such as those used by Bell, Porat and Jones disguise the complexity and diversity information work and overlook the contributions of the different information occupations to the health and well-being of an information society. For example, Bell's grouping of professional and technical occupations includes engineers, natural and social scientists, teachers, medical and health personnel as well as a general category of accountants, clergy, lawyers, judges and librarians among others. While the relative size of occupational groupings is no doubt important to the fact of an information society, changes in the world of work and the workplace are also important to the social dimensions of an information society.

We have all experienced some of the changes in the world of work and their broader educational and social consequences. Inner-city areas are reclaimed as residential space by large numbers of knowledge workers, displacing factories and their employees in the process. Work hours are extended to accommodate broader work roles dependent on a resource that does not shut down with the flick of a master switch. Some workforces are reduced as people are replaced by information technologies capable of rapidly shifting large volumes of codified knowledge. Some industries are regenerated as sophisticated technologies enable reinterpretation of data. The impact of knowledge on work is a topic discussed in popular business magazines on sale at newsagents. These changes are captured in an advertisement that I clipped from a newspaper supplement a few months ago.

> Positions vacant: Team leader for exciting new e-business. Successful applicant should be disloyal, break rules, resent authority, ignore punctuality and flout dress codes. CBD, $150K + options. The new e-economy isn't just redefining the nature of business but it's completely upending the qualities expected of the

middle and senior executives who drive it. Shareholders who've tasted the multiples that pour from online now demand more than old style wealth maintenance - instead wealth creation. The kind provided by the shock troops of the hot desk world. The best of whom are a lore unto themselves…'

Behind the extravagant phrases are trends that we have seen played out over the past few years and the three themes that concerned Daniel Bell almost forty years ago. Missing from the advertisement though is any suggestion that not all of us want to, or are able to join the shock troops in their hot desk world.

4. Spatial

For Webster this perspective draws on the geographer's sense of space. It emphasises the information networks that connect locations and affect the organisation of time and space. The convergence of telecommunications and computing has enabled the development of networks that are characterised by an ever-increasing flow of information at increasingly high speeds. The perspective is captured in the image of an information infrastructure similar to an electricity grid or a highway and it has shaped a number of key government initiatives in some countries, most notably the United States. There are also initiatives aimed at the development of a global information infrastructure.

Central to the networks is their traffic or information flow. We have experienced the enormous increase in traffic on the networks that we use in our workplaces. Virus infection has taken on a new meaning and we use scanners to maintain the health of our networks. Organisations can respond more rapidly to their customers and suppliers and in the process develop new kinds of relationships with them. Educational institutions can respond more effectively to the learning needs of their students through their use of networks as communication tools and delivery mechanisms for personalised learning resources. Young people use ICQ and chat rooms as a communication medium of choice. The electronic networks are free of the time and space constraints of the physical landscape. Time and space take on different dimensions. This does not mean though that the networks always offer forms of communication that are suitable substitutes for face-to-face interactions.

As we have seen with the other perspectives so far there are some limitations inherent in the spatial perspective. The technology again assumes an importance that threatens to overshadow the flow of information as the essential element of the networks. If the volume of network traffic is a sign of an information society then where does that leave considerations of the quality and impact of the information that is stored, transmitted and retrieved by the networks? The significance of the answer to this question can be appreciated in two ways, the first through electronic library projects and the second a development in my home state of New South Wales. I assume that you have been involved in digital library initiatives in your own university libraries. I would ask you to reframe one of these as a networking project designed to connect the library with its users of electronic information resources and then to consider what is omitted when the initiative is conceptualised only as a networking project.

In New South Wales the development of nsw.net is much more than a networking project. That this is so is highlighted by the fact that the

lead agency in this multi-million dollar government funded project is the State Library of New South Wales. Small and large country towns, provincial cities, suburbs and Sydney CBD are being connected through the public library network that is coordinated through the State Library. The opportunities that nsw.net will provide for community development in all areas of the State, especially those that are geographically isolated, are almost limitless. This is a project that has the potential to explore some of the technological, informational, social and economic dimensions of networking.

5. Cultural

The final perspective to be considered is the cultural. The information environment in which we live, work and play is laden with both media and meaning. The films we see, the television programs we watch and the books we read are shared with people in other parts of the world, mainly in the English speaking world. Style icons and fashion brands are recognisable on most continents. Young people the world over dance to the same music and videoclips. Culture shock seems to be a condition of travel in the past. I heard a radio interview with a Canadian visitor last week and he commented that he felt quite at home in Adelaide the minute he stepped off the plane. Perhaps that is an experience that our overseas delegates have also shared in the past few days. The point of these examples is that not only have the informational dimensions of social and cultural artifacts been transferred world wide through the media but so too have the symbolic and meaning dimensions of those artifacts.

The cultural perspective throws into sharp relief an area of tension relevant to the Conference theme: the local and the global. At the local level, community groups quite reasonably expect to assert and strengthen their identities and nurture their heritage. At the same time we are part of a global community with opportunities through the networks to develop social ties irrespective of national, geographic or cultural barriers. Yet these very opportunities carry with them considerable potential for the development of an impoverished culture of a kind that denies the richness and traditions of our cultures and therefore our humanity. One commentator has in fact suggested that the success of the knowledge economy is dependent more on a cultural revolution than on information technology. At the core of the revolution is the development of capabilities for managing and using the vast quantities of information that are available to us so that we can continue to maintain a sense of identity and ensure it is recognised by others.

We have now surveyed the notion of an information society from five different perspectives, none of which is itself adequate to the task of describing an information society. It is impossible to attribute the development of an information society to either the spread of information technologies or to the increasing availability of information. In any event the economic, spatial and cultural perspectives reinforce the need to consider the contexts in which information and the technologies are applied and used. The five perspectives together highlight the complex nature of an information society and the communities that are an integral part of it. Whether or not we are an information society is perhaps a moot point. The fact of change in the information ecology is inescapable.

An approach to information

In our discussion so far we have not attended to the nature of information although we have made an implicit distinction between information and knowledge. This is not a problem in itself but it does become one when we want to assess the impact of information, say in the workplace, or we want to develop policies for access to it and strategies for improving the use of it. We need to know what it is that we mean by the term. The traditional hierarchy of data, information, knowledge and wisdom is useful to a degree but there remains general confusion surrounding the boundaries of each level in the hierarchy. The confusion is compounded by the degree of human information processing that has come to be associated with each level and by the different connotations ascribed to the terms in the hierarchy by different fields of professional practice. The word 'information' has come to be almost meaningless, a weasel word.

Given what I take to be the central place of information in an information society we need to attend to the meaning of the word in ways that are helpful to us. I would like to briefly outline an approach to information that is potentially useful in this context. I then want to overlay it on the five perspectives that we have explored as a way of identifying strengths and weaknesses in our thinking about information in an information society. We should then be in a position to identify some information-related issues that are relevant to universities. There are of course other approaches to information that will no doubt be explored during the Conference, especially in the papers directed towards knowledge management and supporting student learning.

The approach I want to outline here comes from Michael Buckland who is familiar to many of us through his work on academic and digital libraries. Buckland has based his approach on common usage of the word 'information' and what it is that is informative. He identifies three different kinds of information: information-as-thing, information-as-process and information-as-knowledge. Rather than a hierarchy based on differences among levels, this approach reinforces the commonality and relationships among the different kinds of information while at the same time acknowledging differences as well. For example, information-as-thing is tangible but information-as-process and information-as-knowledge are both intangible. Information-as-thing and information-as knowledge are both entities, but information-as-process is a process. This approach suggests that information and communication technologies (and information systems whether or not they are technology-based) deal directly with information-as-thing as well as with representations of knowledge in a tangible form. Information-as-process is concerned with becoming informed and so with making meaning. Information-as-knowledge is 'personal, subjective and conceptual', or the meaning that is made as a result of becoming informed. It is these characteristics of information-as-knowledge that present some difficulties to the proponents of knowledge management who claim that knowledge can be managed.

We can place Buckland's categories of information over the five perspectives that we have explored according to the kind of information that is implied in each perspective. To a large extent this is a matter of judgement but the discussion about the alignment of different kinds of information with each perspective is one way to start clarifying our thinking. The table below illustrates the overlay of the perspectives with different kinds of information.

	Information-as-thing	Information-as-process	Information-as-knowledge
Technological	4		
Economic	4		
Occupational	4		
Spatial	4	4	
Cultural		4	4

Most of the perspectives focus on information-as-thing. Yet none is static. The technologies are continually evolving to provide access to information in different forms and to facilitate the sharing of tacit knowledge. Different approaches to economics are being developed in response to the emergence of information and knowledge as key factors in the global economy. New occupational groupings are emerging as people develop new capabilities. Traffic through the networks flows in changing patterns. Theorists are critiquing the culture of cyberspace and are engaging with the tensions between local and global issues.

A question that arises is: What markers are appropriate to chart the development of an information society in relation to information-as-process and information-as-knowledge? Already work in this area has begun. Alan Burton-Taylor for one has identified signs of what he sees as the knowledge-based economy. Its characteristics include an increasing use of symbolic goods, as in electronic banking and e-commerce, the demassification and distribution of physical resources as we have seen in distance learning and just-in-time information services and the boundaryless enterprise that spills over national and geographic borders. The fundamental and central importance of human creativity and intelligence in what is termed 'the weightless world' by Coyle resonates very much with the premium placed by Drucker and Burton-Taylor on knowledge as the key economic driver and resource in an information society. These approaches to information-as-knowledge have the potential to extend the spatial and cultural perspectives suggested by Webster rather than require the addition of new markers. If this is the case then we are on the path to an information society of a different order to that originally envisaged.

Information issues for universities

With their remit for the creation and transmission of knowledge universities have a unique role in an information society. Certainly the unprecedented pressures that have had an impact on many organisations have buffeted universities as well. In many instances they have responded imaginatively and created new opportunities for themselves. In my experience our universities have given lie to the saying that it is harder to change a university than move a cemetery. The goals of universities are still based on the creation and transmission of knowledge. What has changed is not the goals but the ways in which universities go about achieving them.

From an information point of view there are two particular issues for universities in an information society. Both are connected to the creation and transmission of knowledge, one related more to knowledge production, the other more to learning. Both reflect the sorts of changes that resonate with the five perspectives that we have discussed and both are concerned with information-as-process and information-as-knowledge. First of all I would like to consider new modes of knowledge

production and then I would like to explore the implications of the free flow of information.

1. New modes of knowledge production

Among the best-known analyses of the changes in the way that knowledge is being produced is the analysis presented by Michael Gibbons and his colleagues. Although Mode 2 is claimed to be a new form of knowledge production I would suggest that it is well known among the technological universities where there are already strong and productive links among these universities, business, industry and the professions. Some of the critics of the characterisation of two different modes of knowledge production argue that they have both always existed side by side and that what is new is a shift away from the dominant Mode 1. The two modes are summarised below in terms of the context of knowledge production, their disciplinary orientations, the organisational diversity required by each mode, accountability factors and finally quality control in each mode.

i. Context

Mode 1: Problems are set and solved in a context governed by the academic interests of a specific community.

Mode 2: Knowledge production is carried out in a context of continuous negotiation, for example with government, industry, society and so knowledge is socially distributed. Intellectual and social demands inform the context.

ii. Disciplinary orientation

Mode 1: Knowledge production is disciplinary.

Mode 2: Knowledge production is transdisciplinary and this is reflected in all phases from the evolution of a framework to guide problem solving through to the diffusion of the knowledge that is produced.

iii. Organisational diversity

Mode 1: The skills and experience that people bring to knowledge production are relatively homogenous and so too are the sites where knowledge is created.

Mode 2: The skills and experience brought to the problems are heterogeneous. The sites of knowledge creation are diverse and include research centres, government agencies, consultancies, as well as universities. Multiple sites are often linked in different ways through networks of communication. Research groups are not highly institutionalised and members reassemble in different combinations in different sites to work on new problems. The experience of members is transferred to new contexts. Patterns of funding are also diverse and the expectations of the funding providers enter into the context of knowledge production.

iv. Accountability

Mode 1: The discipline has traditionally been the source of accountability.

Mode 2: The knowledge production process is marked by social accountability and by reflexivity on the part of those involved.

v. *Quality control*

Mode 1: Quality is assured and control exercised through the peer review process.

Mode 2: There are additional criteria for determining quality applied through the context of knowledge production. Along with intellectual criteria are social, political, or economic criteria. The quality control process is broadly based.

There are aspects of an information society that demand Mode 2 research and knowledge production. Foremost among these is the need to know more about the social and cultural aspects of information technology. Pertinent here is the emerging field of social informatics, defined by one of its leaders, Rob Kling, as 'the interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts'. Perhaps it is this field that might inform research and scholarship, debates and action agendas of the kind that bring information-as-process and information-as-knowledge more sharply into the purview of the technological perspective.

Mode 2 knowledge production makes demands on universities while at the same time providing opportunities to engage with partners in new ways in the interests of longer-term collaborations. Among the demands are a commitment to strategic alliances, new and flexible ways of providing services and the provision of a fairly sophisticated technological infrastructure that will support networking and information exchange often as a replacement for face-to-face interaction. Consideration needs to be given to intellectual property issues, staff development initiatives and ongoing evaluation of the benefit and value of partnerships that support socially distributed knowledge production. Of course there are emerging and changing roles for libraries in these collaborations with the prospect of partnerships not only with knowledge creators within the universities but also in the collaborating partners.

2. Free flow of information

This is an issue that goes well beyond the question of whether the Internet should be censored, a topic that deflects attention from the broader social, cultural and educational bases for the free flow of information. Fundamental to the free flow of information are considerations of access to information that can be regarded as occurring at three interconnected levels in an information society. Universities have a key role in knowledge transfer and the diffusion of information at each level: societal, institutional and individual.

At the societal level the free flow of information has implications for policy making by government. The Australian government's current strategy focus on the Internet and e-commerce must broaden soon so that the intended social benefits from government investment in infrastructure can be realised. This might be more a matter of policy and strategy coordination of the kind that is developing in the United Kingdom through the People's Network and the National Grid for Learning. In Australia policy coordination has been advocated by the Australian Vice-Chancellors Committee in its submission to the Information Economy Action Plan which is soon due for release. Copyright laws and lending rights legislation also have an impact on the free flow of information

and are matters that reflect and are shaped by social attitudes towards information, its value and benefits.

The level of access to the flow of information and knowledge in a global society extends beyond national borders. Of real concern is the imbalance between the North and the South not only in terms of access to information but also in terms of relative contributions to the global stock of documented information and knowledge that is currently dominated by a few countries. The situation has been described in the following way: 'we have got rid of skin colour-based apartheid but are now facing the emergence of an information access-based apartheid'. The outcomes of the G8 Summit at the end of this month in Japan should provide some directions for creating the global information society and strategies for addressing the imbalance. Universities need to consider their response to any directions that emerge especially in light of our commitments to international students, many of will be returning to their own countries to practice in their chosen fields.

The second level of focus for the free flow of information is the institutional level. In an information society universities are key nodes in information and knowledge networks, both real and virtual. Their research and learning programs ensure that they play a dynamic role in those networks. The pattern of social distribution of knowledge creation is reflected increasingly in the transmission of knowledge through flexible-, distance- and work-based learning initiatives. You will have your own examples of changes in ways of working with academics, their students and their industry and community partners to exchange with each other. University libraries are no longer only service providers but are also becoming established as content providers and product developers. Librarians are developing roles in teaching and learning practice and well as information practice. There are parallels too in research programs, especially where research and information practices converge in the diffusion of innovation and scholarly communication.

There is another role for university libraries that is very much identified with information practice. As organisations and businesses, universities inevitably continue to assume the characteristics of knowledge-based enterprises. In this context, the expertise and experience of some librarians is extremely valuable to the management of universities. Librarians understand the difference between information and knowledge and they are able to work with a variety of formats. They understand concepts such as information need and information utilisation and they are skilled in packaging information. They understand the principles of organising information and indexing it for retrieval. They understand the design of information systems and speak the language of system developers. They are very well placed to make significant contributions to information and knowledge management at an institutional level.

The third level to consider in relation to the free flow of information is the level of individual information users. A key concern here is informational poverty, a concept developed about fifteen years ago but becoming increasingly relevant. It refers to a shortage of needed information that arises from lack of access to it or an inability to find it and use it. The concept is a useful one in an information society because it reinforces the need to have available information

that is reliable, useful and significant to its users. It also highlights the social benefit and value of information. Paradoxically, informational poverty encompasses information overload. Some of the solutions for minimising informational poverty include the development of filtering mechanisms, ensuring the capabilities of information intermediaries, more effective information control and management and the development of more effective information services. An additional solution lies in widespread understanding and acceptance of the role of information in the evolution of human society. In this sense informational poverty is relevant to all three levels of access to the flow of information that I have identified.

Informational poverty can be addressed also through education and especially through information literacy programs designed with academics. But I would suggest that the concept of information literacy needs review in light of our changing knowledge ecology. The models of information literacy that have been applied so far reflect the traditions and assumptions of Mode 1 knowledge creation and diffusion. Newer models need to be informed also by developments in learning, such as situated and collaborative learning, as well as by the emerging technologies and new means of communication. Information literacy more clearly needs to address the needs of personal information management to support lifelong learning.

These three levels of access to information flow are not mutually exclusive. The resolution of issues at one level can have an impact at another level. For example, the development of protocols for electronic document delivery among libraries can enhance the flow of information to individual information users and the cooperative digitisation of key collections in libraries can enhance remote access by individuals to these collections. Universities and their libraries have significant roles at all three levels because of their positions and credibility, their experience and expertise. They are very effective advocates for the development of technologies and networks that support learning and knowledge creation and for the development of an information society that is equitable.

Where to from here?

We have covered a lot of territory and along the way we have highlighted areas of promise and potential as well as gaps and issues to be resolved. We have also glimpsed some opportunities for universities to assert their rightful place in an information society and to ensure their ongoing contributions to a knowledge-based economy. There is one final thought that I would like to leave with you. Chris Duke, the Deputy Vice-Chancellor of the University of Western Sydney cautions us not to be 'dazzled by the sunrise of the virtual universe low over the eastern horizon and blinded to the way ahead - the road beneath our feet'. He argues that the new regionalism created alongside the global economy is yet to be fully understood and grasped by universities who can play a central role in developing learning cities and regions. I want to share with you a quote from an OECD report that Duke refers to in his article. It very neatly draws together many of the paths we have followed this morning.

Given the highly social nature of learning and innovation, it should come as no surprise that these processes often work best when the partners involved are close enough to one another to allow frequent

interaction and easy, effective exchange of information. Indeed a credible and growing body of work emerging from disciplines as diverse as geography, industrial economics, political science, sociology and management studies attests that innovation is fundamentally a geographic process that is facilitated, but not necessarily contained, by spatial clustering of the involved parties within the same region. Proximity is invaluable, along with a shared regional culture as a basis for the social learning which underpins innovation.

Here then lies a very feasible pathway for continuing to redress the dominance of the technological and economic perspectives on an information society and to ensure that the benefits flow to us all. And if we return to the story of *Isaac's storm* that I referred to at the start of this talk I feel confident that there will be sufficient warning of a hurricane of the ferocity of the one that devastated Galveston and its community. I hope that you are too.

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Certification
I certify that this paper is an original contribution and that it has not been copied from or published elsewhere.

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